Appendix 4A

Effects of Suction Dredging On Water and Fisheries Resources
In the Granite Mining Watershed

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Several miners have notified the Forest Service of their intent to suction dredge in selected streams in the Granite watershed by including this activity in their Plans of Operation. Bull Run, Clear, Granite, and Lightning Creeks, proposed for suction dredging, have been identified as ***essential salmon habitat***. McWillis Gulch and Orofino Gulch, also proposed for suction dredging, are NOT ***essential salmon habitat.***

Introduction

To determine the potential effects of suction dredging on streams proposed for dredging, site-specific analyses of streams and stream reaches were necessary. Factors examined included channel morphology, water quality, and channel complexity. The analysis used a series of questions raised by Harvey and Lisle (*1998*), as well as questions raised in other studies to define potential areas of concern. Channel morphology parameters evaluated were stability of the dredge tailings, stability of the channel bed, pool characteristics, and abundance and stability of roughness elements (i.e. beaver dams, log jams). Water quality parameters evaluated were turbidity and stream temperature. Fish habitat parameters evaluated were turbidity, stream temperature, spawning gravels, pool habitat, and channel complexity.

Additionally, several operational factors were considered -- the spatial distribution of suction dredging operations, the specific timing of operations, the size of the dredges and hoses, and in particular, the terms and conditions of the Oregon Department of Environmental Quality's (ODEQ) 700-PM permit (December 31, 2014 expiration date).

ODEQ has generated two fact sheets that discuss the changes that have occurred to the 700PM permit and the reasoning behind the requirements. These fact sheets are found in Appendix 4B.

Analysis Area

The analysis area is limited to the specific streams and reaches with proposed suction dredging. The analysis is further bounded, relative to the potential impacts on the various fisheries and their habitat, by the timing of spawning and re-emergence with respect to dredging. Plans that propose suction dredging are found in Table 4A-1.

Table 4A-1
Plans of Operation that list suction dredging as an activity

Operation Name	Creek	Flow	Essential Salmon Habitat	700 PM Permit applicable sections	303(d) listed for sediment
Blue Sky Bull Run	Bull Run	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	Yes
Blue Smoke	Granite	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	Yes

Operation Name	Creek	Flow	Essential Salmon Habitat	700 PM Permit applicable sections	303(d) listed for sediment
Lightning	Lightning	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	No
Little Cross	Granite	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	Yes
Old Erick	Granite	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	Yes
Republican Comeback 10 & 11	Clear	Perennial/Fish Bearing	Yes	Schedules A, B, and C (all except C.19)	No
Sunshine McWillis	McWillis Gulch	Intermittent, non fish bearing	No	Schedules A, B, and C (except C.16, C.17, C.18, C.19)	No
Yellow Jacket	Orofino Gulch	Intermittent, non fish bearing.	No	Schedules A, B, and C (except C.16, C.17, C.18, C.19)	No

Schedule C.19 was examined to see if it applied to Bull Run or Granite Creeks which are 303(d) listed for sedimentation. Schedule C.19 states:

> "Suction dredging is prohibited on any stream segment that is listed as water quality limited for sediment, turbidity or toxics on the list published by DEQ pursuant to OAR 340-041-0046. **This prohibition does not apply, however, to stream segments that were properly subject to mining under the 700-J permit between May 3, 1999 and July 1, 2005,** or to stream segments subjects to total daily maximum load (TMDL) that specifically authorizes mining under the 700 PM permit."

While there is a recently completed TMDL Plan for the John Day River Basin (ODEQ 2010), the Plan did not address sediment loads, only temperature, bacteria, and dissolved oxygen. However, suction dredging did occur on these streams between 1999 and 2005 and so is grandfathered in because continued suction dredging on these streams would not constitute a new load (A*. Johnson, UNF fisheries biologist, email dated 5/1/13*). Therefore, Schedule C.19 does not apply on these two streams.

Information Used

This appendix provides the background information used to assess potential effects of suction dredging in the Plan-specific effects analyses (Appendix 8). The following information was used to evaluate potential impacts:

1. Peer-reviewed literature and various reports,
2. Dredge hose size and distribution of suction dredging activity, and

3. The Oregon Department of Environmental Quality's 700-PM permit requirements.
4. State map showing streams listed as essential salmon habitat: *http://www.oregon.gov/dsl/PERMITS/Pages/counties_ess.aspx*

ODEQ 700-PM permit

The 700-PM permit states that "Areas designated as essential salmon habitat are restricted to small suction dredges not to exceed 16 horsepower with an inside diameter intake nozzle no greater than 4 inches" (Schedule C, #18). The permit does not specify a location and is not submitted to the Forest Service. Any effects analysis of dredging is a minimal effects analysis because the impact of dredging varies as a function of dredge size, distribution and number of dredges, stream size, the fineness of the sediments, and flow regime (*Harvey 1986*). However, unless given permission by the miner who has a claim in an area, another individual may not suction dredge the portion of the stream that flows through the claim. As such, the spacing of mining claims provides zones of limited suction dredging activity. Operations are restricted by the State to daylight hours and the particular instream work window for each watershed. See the following website for details:
www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater2008.pdf

All dredging operations included in this analysis proposed to adhere to the terms of the 700-PM permit, and were subsequently evaluated on a site-by site basis following Forest Service mining regulations at 36 CFR 228 Subpart A.

It should be noted that the 700-PM permit restrictions and requirements do not replace or supersede Federal laws and Forest Service regulations. How the Forest Service regulates mining operators on National Forest System lands under the Forest Service's locatable mineral operations regulations at 36 CFR 228 Subpart A remains unchanged. A mining operator conducting or proposing to conduct instream suction dredge operations within National Forest System lands must be in compliance with 36 CFR 228 Subpart A regulations, whether operating under a Notice of Intent or an approved Plan of Operations. The operator is responsible for his or her own compliance with all applicable State and Federal laws and regulations.

Literature Review and 700 PM permit

The peer-reviewed literature on suction dredging impacts is limited and focuses largely on impacts to fish, aquatic insects and benthic invertebrates. Channel morphology and water quality information was sometimes included because of their influence on the habitat requirements of these organisms. When reviewing the literature, dredge size and numbers, channel characteristics and study location were noted to place the literature in its proper site context. To varying degrees the papers discuss the spatial and temporal extent of the changes. Information specifically relevant to understanding and determining the direct, indirect, and cumulative effects of suction dredging in the Granite watershed is presented in the following paragraphs. All literature is located in the project file along.

Channel width and sinuosity

Low-flow channel width can be increased and low-flow channel sinuosity decreased by suction dredging as a result of removal of gravel/cobble bars. However, the 700-PM permit restricts the types and amount of channel bars that can be suction dredged, thereby decreasing the extent of impact. In streams that are NOT essential salmon habitat, dredging is allowed into non-vegetated gravel bars up to 10 feet outside the wet perimeter of the stream (*Schedule C.12*), but the gravel bar must be devoid of “any rooted vegetation, located either between the stream banks and the wet perimeter of the stream or entirely within the wet perimeter of the stream” (Definition #5). This would apply to McWillis Gulch and Orofino Gulch.

In *essential salmon habitat* dredging is further restricted: “Mining in essential salmon habitat is restricted to the wet perimeter of the stream (C.18). This applies to Bull Run, Clear, Granite, and Lightning Creeks.

Channel complexity and roughness

Channel complexity and roughness are provided by boulders, log jams, beaver dams, and stream bank vegetation. The ODEQ 700-PM permit limits the amount and conditions by which boulders, logs, or other stream infrastructure can be removed Schedule C.6, C.7, and C.8.

“Undercutting or eroding stream banks and removal or disturbance of boulders, rooted vegetation, or embedded woody plants and other habitat structure from stream banks is prohibited…. (C.6).”

“Moving boulders, logs, or other natural stream infrastructure within the stream channel is allowed. However, in no case may this infrastructure be removed entirely from the stream channel (C.7).”

“Removal of habitat structure that extends into the stream channel from the stream bank is also prohibited (C.8).”

Therefore, log jams attached to the stream bank and beaver dams would not be disturbed or destabilized because both features are directly attached to the stream banks. However, boulders or log jams contained within the channel and not attached to the stream banks could be moved. As a result, suction dredging has the potential to locally alter channel complexity and roughness.

Channel bed stability and morphology

Channel bed composition determines channel bed stability and thus the potential for suction dredging to alter pool/riffle distributions and characteristics and/or create a knickpoint which would might headcut and lead to channel incision. Harvey and Lisle (*1999*) found that scour and fill varied spatially as a function of bed composition and variability in stream flow. Thomas (*1985*) found that deposited sediment increased 10-20 times over background levels immediately downstream of a dredge, and then decreased exponentially downstream. His study found that the bulk of the sediment stirred up by dredging was redeposited within 6-11 meters, and in one case the gravel deposited by the dredge had moved into and filled a pool. Somer and Hassler (*1992*) found increases in sedimentation below dredges on some streams and not others, suggesting the role of substrate composition in determining the potential for pool infilling. Therefore, it is possible that if a pool exists immediately downstream from a dredging operation, there may be some reduction in that particular pool’s depth as a result of infilling by sands and gravels.

The literature distinguishes between natural riffles and dredge tailings and found that the stability of these features differ. The natural riffles have adjusted over time to variable instream flow conditions and tend to be stable. The stability of the suction dredge tailings, however, is a function of the tailings composition, and its impact on channel bed morphology varies accordingly. Thomas (*1985*) found that gravel tailings are unstable. All the gravels deposited by the dredge in his study stream had moved downstream one year after dredging. Somer and Hassler (*1992*) also found that that the “dredge pocket and pile” stream morphology was short term, and that the dredge holes and tailings were no longer visible the following summer. In contrast, Harvey and Lisle (*1998*) noted that rocks too large to pass through dredges are commonly piled, and that these piles can persist during high flows. These imposed topographic high points have the potential to destabilize channels during high flows, depending on site characteristics. They also noted that suction dredging may cause natural riffle crests to erode, causing upstream pools to become shallower. The potential for natural riffle crests to erode depends on the riffle composition and location of the dredging operation with respect to riffle crests. Therefore, there is the potential for suction dredging to alter distribution of riffles and destabilized channels under certain site conditions.

Stream bank stability

Dredging of stream banks can result in large amount of fines entering the stream, decrease stream bank stability, and decrease shade. However, Schedule C.5 of the ODEQ 700-PM permit prohibits dredging of stream banks, undercutting or eroding them or removing boulders, rooted vegetation, or embedded woody plants from stream banks. In addition, so long as the channel bed composition was resistant to instream scour, a suction dredge pool would not be expected to trigger a headcut which, if it happened, would increase stream bank sensitivity to instream erosion by increasing bank heights. Therefore, dredging would not destabilize the banks and contribute sediment into the creeks, either by removing bank vegetation or undercutting the banks.

Stream Temperature

Current temperature conditions in the NFBR watershed are the result of historic activity which resulted in channel incision, widening, and straightening, a lowering of the groundwater table, and the removal of riparian woody vegetation. The 700-PM permit prohibits dredging in the stream banks or removing stream side vegetation. Therefore, suction dredging will not alter either the actual stream temperatures or their patterns, unless dredging triggers a channel headcut. In this case, the increased bank heights, as a result of channel incision, would make the stream banks more sensitive to instream erosion and the evolution of a wider channel. The increase in channel widths would result in a decrease in water depths for the same discharge and thus an increase in stream temperatures. Channel incision would also lead to a lowering of the water table, reducing the influx of cooler groundwater base flows into the stream. This would also lead to increased stream temperatures and a potential shift from perennial to intermittent flow.

Turbidity

With respect to potential turbidity plumes, the 700-PM permit requires the following:

> "…must not create visible turbidity beyond 300 feet downstream or down current. In no case may the visible turbidity cover the entire wet perimeter (Schedule A.1)"
>
> "If any visible increase in turbidity… is observed above background turbidity beyond any point more than 300 feet downstream or downcurrent from the activity at any time, the operation must be modified, curtailed or stop immediately so that a violation as defined in Schedule does not exist…. (Schedule A.2).
>
> "…Visual monitoring must be performed once a day during daylight hours (Schedule B.1)"
>
> "Visual monitoring of wastewater discharge must be conducted immediately downstream or down current from the mining activity until the turbidity plume is no longer visible (Schedule B.2)."

Research examining turbidity plumes found that depending on the amount and type of fines in the substrate and the stream gradients, plume distances varied from being non-detectable below a dredge or only a few meters in length (*Griffith and Andrews 1981*), to 80 plus meters (*Harvey 1986*), to more than 123 meters downstream (*Somer and Hassler 1992*). Only Griffith and Andrews (*1981*) identified the percentages or makeup of the fines in the substrate. They found that sediment less than 0.5 mm (silt) composed 13 and 18 percent of the substrate on their two streams. Sediment less than 4mm (fine gravel) made up 58% of the material dredged in both streams.

Thomas (*1985*) found in his study that deposited sediment increased 10-20 times over background levels immediately downstream of a dredge, and then decreased exponentially downstream. His study found that the bulk of the sediment stirred up by dredging was redeposited within 6-11 meters, and in one case the gravel deposited by the dredge had moved into and filled a pool. Somer and Hassler (*1992*) found increased in sedimentation below dredges on some streams and not others suggesting the role of substrate composition in determining the potential for pool infilling. Harvey and Lisle (*1999*) found that scour and fill varied spatially as a function of bed composition and variability in stream flow. Therefore, there is the potential for suction dredging to increase turbidity and suspended sediment in a stream depending on the channel bed composition.

References

Griffith, J. S. and Andrews, D. A. (1981). Effects of a small suction dredge on fishes and aquatic invertebrates in Idaho streams. *North American Journal of Fisheries Management,* 1, 21-28.

Harvey, B. C. (1986). Effects of suction gold dredging on fish and invertebrates in two California streams.

Harvey, B. C. and Lisle, T. E. (1998). Effects of suction dredging on streams: a review and an evaluation strategy. *North American Journal of Fisheries Management,* 6, 401-409.

Harvey, B. C. and Lisle, T. E. (1999). Scour of Chinook Salmon redds on suction dredge tailings. *North American Journal of Fisheries Management,* 19, 613-617.

Johnson, A. (2013). Email from Allison Johnson, Umatilla National Forest fisheries biologist, dated May 1, 2013 with information from Beth Moore of Oregon Department of Environmental Quality.

Keller, E. A. (1971). Areal sorting of bed-load material: the hypothesis of velocity reversal. *Geological Society of America Bulletin* 82:753-756 *as cited in*: Harvey, B. C. and Lisle, T. E. (1998). Effects of suction dredging on streams: a review and an evaluation strategy. *North American Journal of Fisheries Management,* 6, 401-409.

Kennedy, R. (1997). Road Maintenance Frequency vs. Sediment Production. In FS Engineering Field Notes, December, pp. 11-15.

Oregon Department of Environmental Quality. *www.deq.state.or.us/WQ/wqpermit/mining.htm,*

Somer, W. L. and Hassler, T. J. (1992). Effects of suction-dredge gold mining on benthic invertebrates in a northern California stream. *North American Journal of Fisheries Management,* 12, 244-252.

Thomas, V. G. (1985). Experimentally determined impacts of a small, suction gold dredge on a Montana stream. *North American Journal of Fisheries Management,* 5, 480-488.